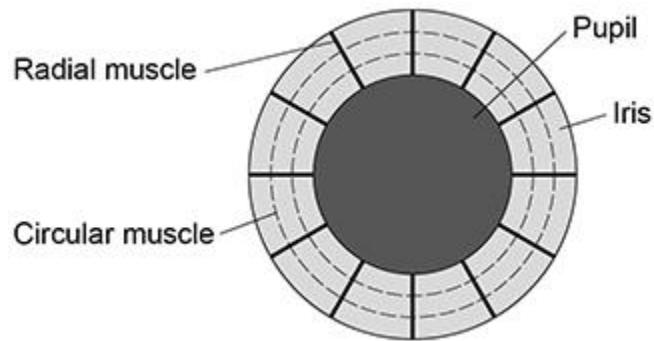


Q1.

The iris in the human eye is a muscular structure. The iris changes the size of the pupil.

The diagram below shows the muscles in the iris.



- (a) Suggest and explain how the interaction between the muscles labelled in the diagram above could cause the pupil to constrict (narrow).

(2)

- (b) The fovea of the eye of an eagle has a high density of cones. An eagle focuses the image of its prey onto the fovea.

Explain how the fovea enables an eagle to see its prey in detail.

Do **not** refer to colour vision in your answer.

(3)

- (c) The retina of the human eye has an area of approximately $1.094 \times 10^3 \text{ mm}^2$
The circular fovea in a human eye has a diameter of $3 \times 10^3 \mu\text{m}$
Calculate the area of the fovea as a percentage of the area of the retina.
The area of a circle is πr^2 . Use $\pi = 3.14$ in your calculation.
Show your working.

Answer _____ %

(2)

- (d) The retina of an owl has a high density of rod cells.
Explain how this enables an owl to hunt its prey at night.
Do **not** refer to rhodopsin in your answer.

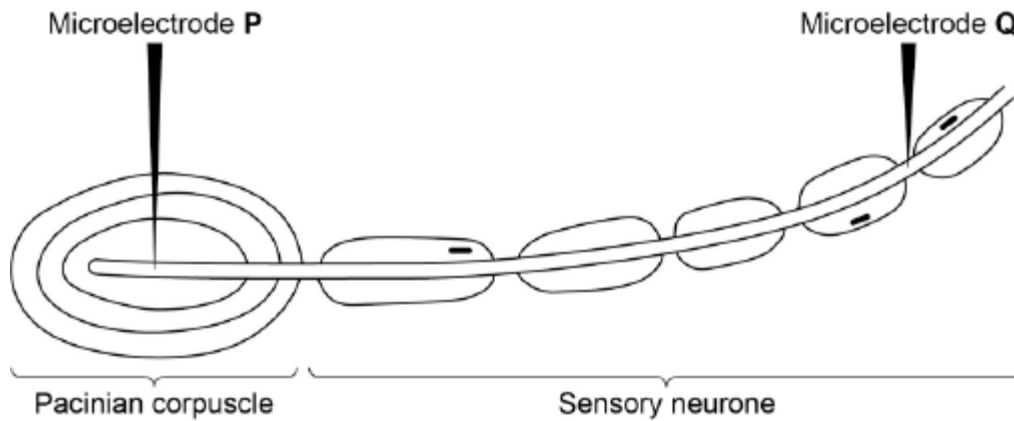
(3)
(Total 10 marks)

Q2.

A biologist investigated the stimulation of a Pacinian corpuscle in the skin of a fingertip.

She used microelectrodes to measure the maximum membrane potential of a Pacinian corpuscle and its sensory neurone when different pressures were applied to the fingertip.

The figure below shows the Pacinian corpuscle, its sensory neurone and the position of the microelectrodes.



The table below shows some of the biologist's results.

Pressure applied to the fingertip	Membrane potential at P / millivolts	Membrane potential at Q / millivolts
None	-70	-70
Light	-50	-70
Medium	+30	+40
Heavy	+40	+40

(a) Explain how the resting potential of -70 mV is maintained in the sensory neurone when no pressure is applied.

(2)

(b) Explain how applying pressure to the Pacinian corpuscle produces the changes in membrane potential recorded by microelectrode **P**.

(3)

(c) The membrane potential at **Q** was the same whether medium or heavy pressure was applied to the finger tip. Explain why.

(2)

(d) Multiple sclerosis is a disease in which parts of the myelin sheaths surrounding neurones are destroyed. Explain how this results in slower responses to stimuli.

(2)

(Total 9 marks)

